

# *FM3101*

## *(Fleet Management)*



**USER MANUAL**  
**V1.0**



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This document describes FM3101 terminal features, architecture, possibilities, interfaces and communication protocols.

## **LEGAL NOTICE**

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## 1. SHORT DESCRIPTION

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FM3101 is a terminal with GSM and GPS connectivity, which is able to get device coordinates and transfer them via GSM network. This device is perfectly suitable for applications where location acquirement of remote objects is needed. It is important to mention that FM3101 has additional inputs and outputs, which let you control and monitor other devices on remote objects. There is integrated 1-Wire® I/O (for Dallas digital thermometer or I-Button reader). Also it has RS232 port (possibility to connect any external device for example barcode reader, RFID reader etc.) Apart from that, the device is fully programmable, so you can load a special Java™ IMlet and perfectly adapt it for your needs.

FM3101 has rechargeable battery inside and special controller for power management. Because of this new feature, GPS/GSM unit can operate for some time without external power supply. Special power saving algorithm can be implemented in Java™ IMlet and working time can be expanded up to 3-5 times.



## 2. PACKAGE CONTENTS

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### MAIN PARTS

1. FM3101
2. PC <-> FM3101 serial cable port 1/2 (for configuring modem)
3. PC <-> FM3101 serial cable port 3 (for NMEA -> PC)
4. 2x10 plug with cables for power supply, inputs and outputs
5. CD with Aplicom Datasheets, SDK and User Manual
6. Separate GPS and GSM antennas or Combined antenna may be ordered

### ACCESSORIES

7. Temperature sensor TTJ-101 (optional)
8. Voltage adjuster GCM-100 (optional)



### 3. MAIN FEATURES

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- ✓ Track your remote objects (trucks, cars, ships etc) quickly and easily
- ✓ The device supports the following GSM bearers:
  - EDGE class 6 (up to 177,4 kbps).
  - GPRS class 10 (up to 85,6 kbps).
  - HSCSD (up to 43,2 kbps).
  - CSD (up to 14,4 kbps).
  - SMS (text/data).
  - USSD (data).
- ✓ As a lot of connection types are supported, you can choose one according price, reliability, speed or ease of use.
- ✓ Dual-band:
  - European (and Asian) version - 900 MHz / 1800 MHz.
  - American version - 850 MHz / 1900 MHz.
- ✓ The aluminum case of the device is very robust and perfectly suitable for installation into harsh environment such as cars, trucks, boats or other moving objects.
- ✓ Internal rechargeable battery with charge controller.
- ✓ FM3101 has 3 digital inputs, 3 digital outputs and 3 analogue inputs, which could be used for performing tasks on remote objects, such as monitoring fuel tank level, engine status, or controlling truck door etc.
- ✓ FM3101 has 1-Wire® I/O protocol integrated for temperature measuring or key identification.
- ✓ FM 3101 has RS232 port which could be used for external peripheral data acquire.
- ✓ FM3101 is an open architecture device, which is fully programmable, so if you want to perform a very special task, you can totally adapt the device for your needs by writing your own Java™ IMlet or asking our technical staff to make it for you. TCP/IP and UDP stacks are integrated.
- ✓ AutoPIN feature enters the PIN code each time the device is turned on, while SIM card is still protected with code.
- ✓ 3 LED indicators: “Power”, “Status” and “Navigate”.
- ✓ An advanced solution for a very reasonable price.



## 4. MECHANICAL FEATURES

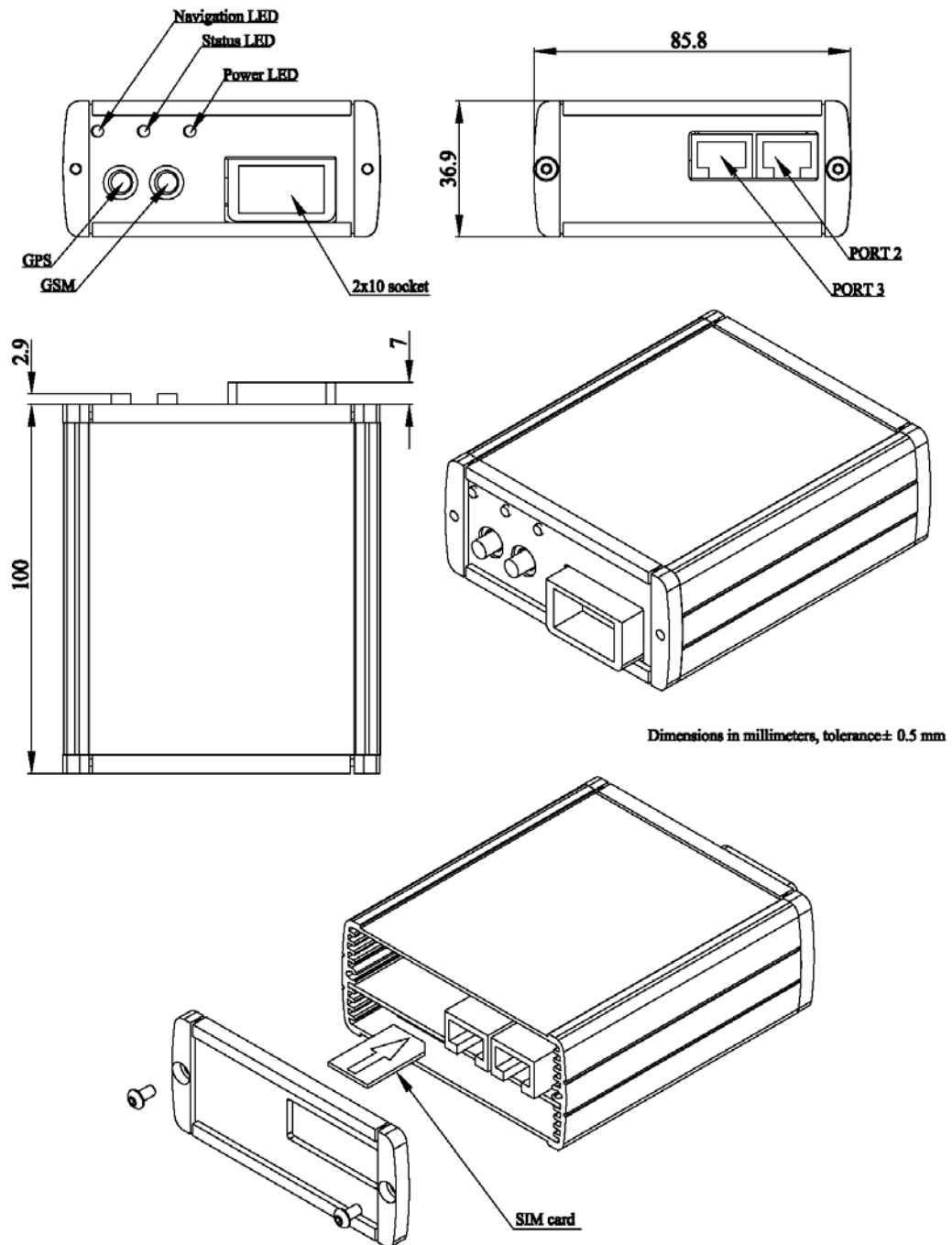


Figure 1. FM3101 drawing & spec



Part name	Physical specification
Navigation LED	Red color LED
Status LED	Red color LED
Power LED	Red color LED
GSM	GSM antenna connector SMA
GPS	GPS antenna connector SMA
Socket 2×10	Tyco Multi-Lock I/O MK-II C-175975
SIM	GSM SIM card socket
PORT 2	RJ45 8 pin socket
PORT 3	RJ45 8 pin socket

Technical details
Power supply 9-30 V DC
Energy consumption:
Stand by mode 30 mA
GPRS max RMS 590 mA, peak up to 2A
Operating temperature: -25°C ÷ +55°C
Storage temperature: -40°C ÷ +70°C
Relative humidity 5÷95%

## 5. CONNECTION & PINOUT

### 5.1 Socket 2×10

ACUM 2	10	20	ACUM 1
"1-Wire®" PWR (+5 V)	9	19	VCC + (10÷30) V
"1-Wire®" DATA	8	18	-
"1-Wire®" GND	7	17	GND
FC 1	6	16	FC 2
OUT 9	5	15	OUT 8
AIN 3	4	14	OUT 6
AIN 1	3	13	AIN 2
IN 9	2	12	GND
IN 7	1	11	IN 8

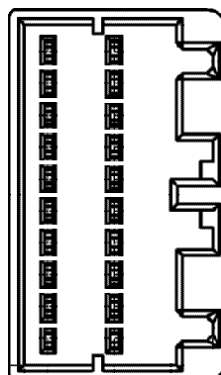


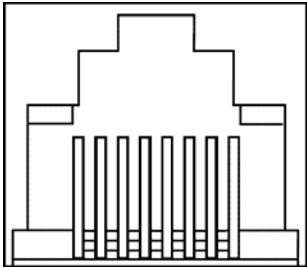
Figure 2. 2×10 socket pinout

Pin Nr.	Pin Name	Description
1	2	3
1	IN 7	Digital input, channel 7. With galvanic isolation.
2	IN 9	Digital input, channel 9. With galvanic isolation.
3	AIN 1	Analog input, channel 2. Input range: 0-2.8V
4	AIN 3	Analog input, channel 3. Input range: 0-2.8V
5	OUT 9	Digital output. Channel 9. Open collector output. Max 500mA.
6	FC 1	Fuel Counter (Quick counter digital input, channel 1)
7	"1-Wire®" GND	Digital output Channel 7, used for Dallas 1-Wire® devices GND (purpose: output could be OFF-ON-OFF to reset device)
9	"1-Wire®" PWR (+5 V)	+ 5 V output (not only) for Dallas 1-Wire® devices
10	ACUM 1	This pin is used connected with pin ACUM 2. Function of those pins – disconnect internal accumulator during shipment or storage. When ACUM 1 and ACUM 2 are connected internal accumulator is on, while disconnected internal accumulator is off.
11	IN 8	Digital input, channel 8. With galvanic isolation.
12	GND	Ground pin.



1	2	3
13	AIN 2	Analog input, channel 2. Input range: 0-2.8V
14	OUT 6	Digital output. Channel 6. Open collector output. Max 500mA.
15	OUT 8	Digital output. Channel 8. Open collector output. Max 500mA.
17	GND	Ground pin.
18	-	-
19	+ (10÷30) V	Power supply for module. Voltage range 10-30V DC. Power consumption in standby mode ~30mA@12V, peak up to 1000mA@12V
20	ACUM 2	This pin is used connected with pin ACUM 1. Function of those pins – disconnect internal accumulator during shipment or storage. When ACUM 1 and ACUM 2 are connected internal accumulator is on, while disconnected internal accumulator is off.

## 5.2 PORT 2 & PORT 3

RJ-45 socket	PORT 2		PORT 3	
 8 7 6 5 4 3 2 1	Pin Nr.	Description	Pin Nr.	Description
	1	-	1	-
	2	TXD_GPS	2	-
	3	-	3	-
	4	GND	4	GND
	5	RXD2	5	RXD3
	6	TXD2	6	TXD3
	7	CTS2	7	-
	8	RTS2	8	-



## 6. INTERNAL ARCHITECTURE

APLICOM 12i modem is equipped with J2ME virtual Java™ Machine. This platform can be used for different user applications. For further documentation of APLICOM 12 modem please contact APLICOM corp. ([www.aplicom.com](http://www.aplicom.com)).

FM3101 has special power management schematics and MCU to control power. It can charge internal battery and turn on or off all peripheral devices for desired period of time. For APLICOM 12i modem power control is used PORT3. Command set can be found chapter 8.1.

Rechargeable battery is able to supply power if there is no external power supply, (life time depends on as frequent data is transmitted). Its lifetime is more then 1000 charge – discharge cycles.

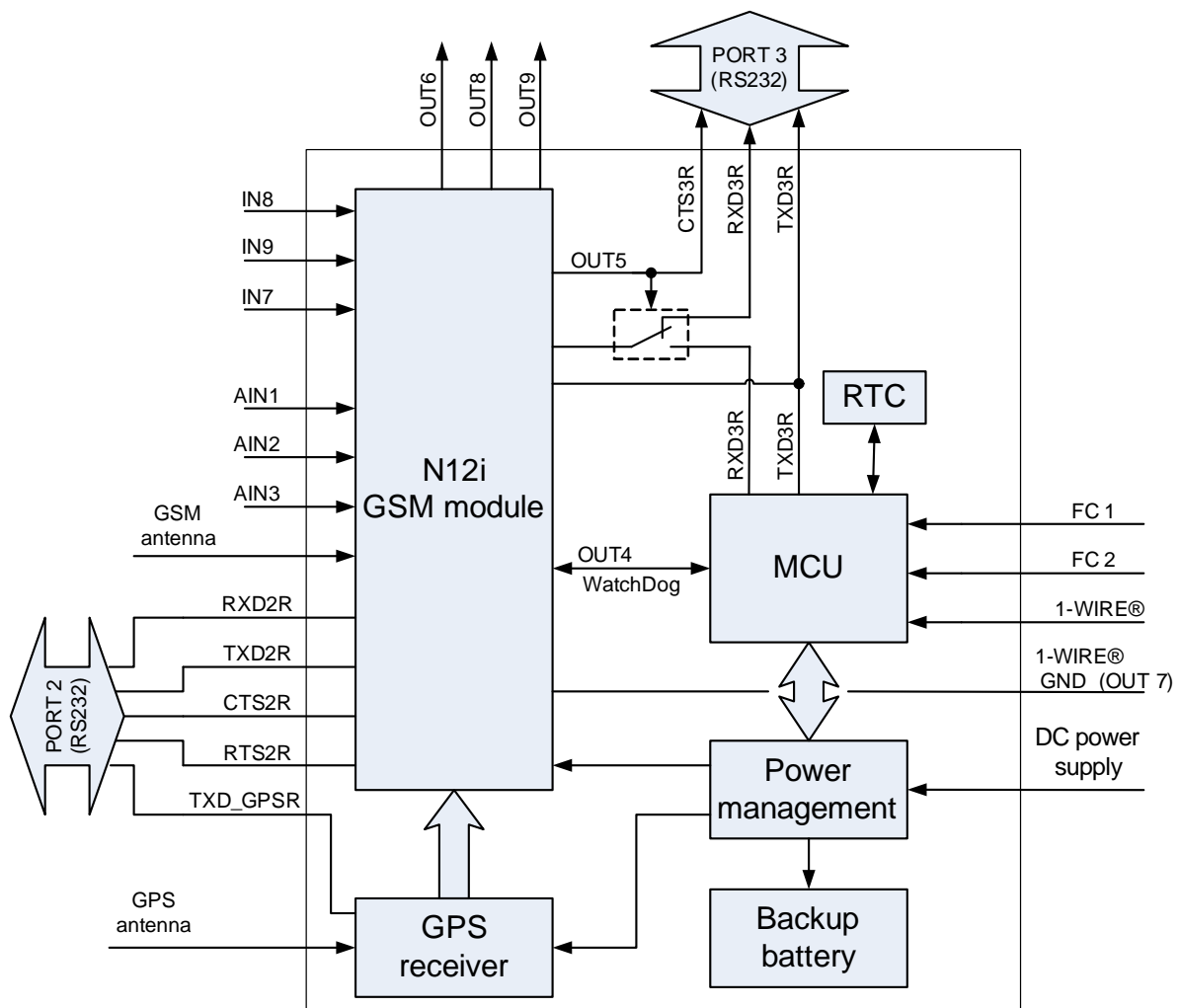


Figure 3. Internal architecture

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## 6.1 1-Wire® devices

One of the FM3101 features is realized 1-Wire data protocol, which enables connection of thermometer (DS1820) and I-Buttons DS1990A reading.

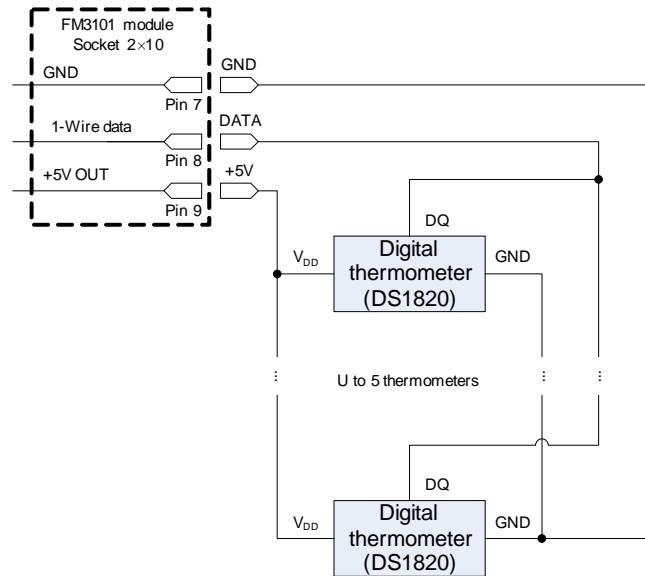


Figure 5. Digital thermometers DS1820 connection scheme

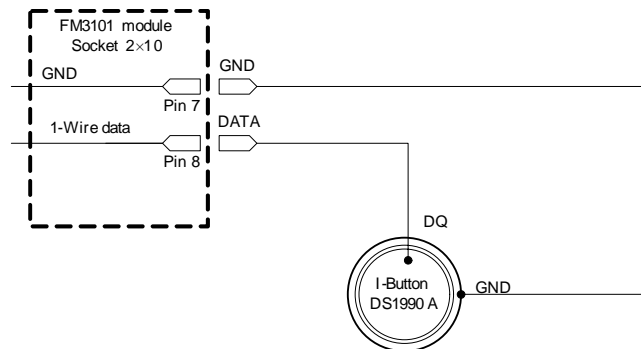


Figure 6. Digital key “I-Button” DS1990A connection scheme



## 7. ACCESSORIES

JSC Teltonika offers accessories to simplify adjusting of sensors with FM3101 analogue inputs and temperature measurement.

### 7.1 Voltage adjuster GCM-001

While maximal voltage of analogue FM3101 input is 2.8 Volts, but some of the sensors output voltage is higher. For that purpose was created voltage adjuster GCM-001 that is proportionally converting voltage.

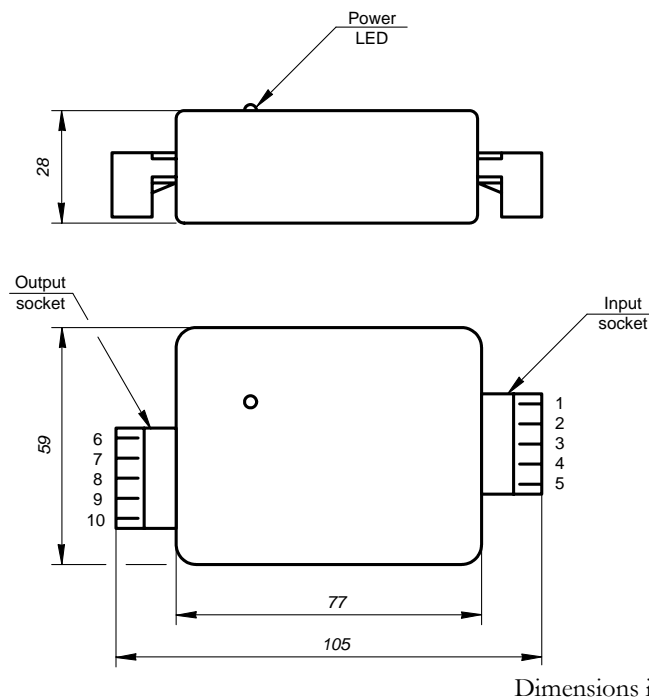


Figure 7. GCM-001 dimensions & spec.

It has three independent channels, so it is possible to adjust three sensors in one device. Also the device has +5 Volts output, which could be useful for some sensors.

Main features:

Supply voltage (Vpp) DC +9 ÷ 30 V

Input voltage range (0 ÷ 27 Volts)

Output voltage range (0 ÷ 2.8 Volts)



Adjusting of the voltage executes by choosing right divisor (placing jumper on one of the four positions) and precise adjusting by twisting amplifier's potentiometer. (Please see the fig.8.).

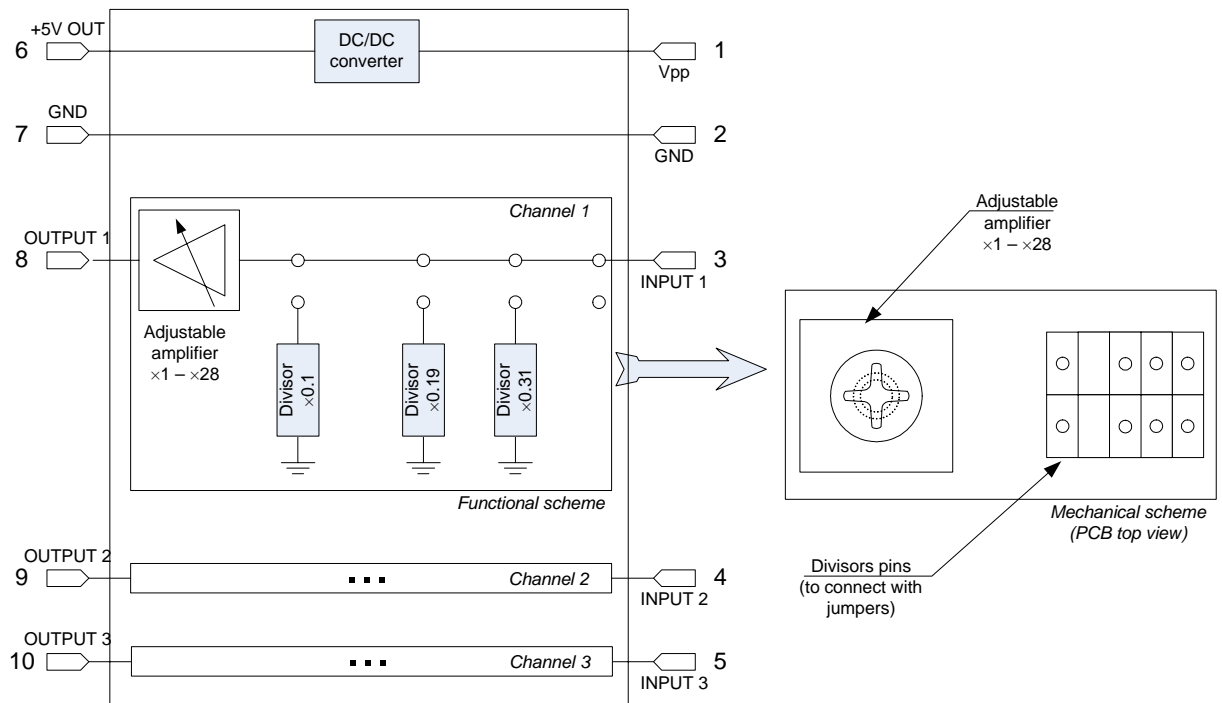


Figure 8. GCM-001 functional and mechanical adjusting scheme



### 7.1.1 Sample of using GCM-001 for tank fuel level measuring

In most of the cars exists fuel tank level sensor, which approximately shows fuel level in indicators panel for driver. It is possible to connect FM3101 through GCM-001 voltage adjuster to get online fuel level data from remote object (if sensor returns analogue signal proportional to fuel level)

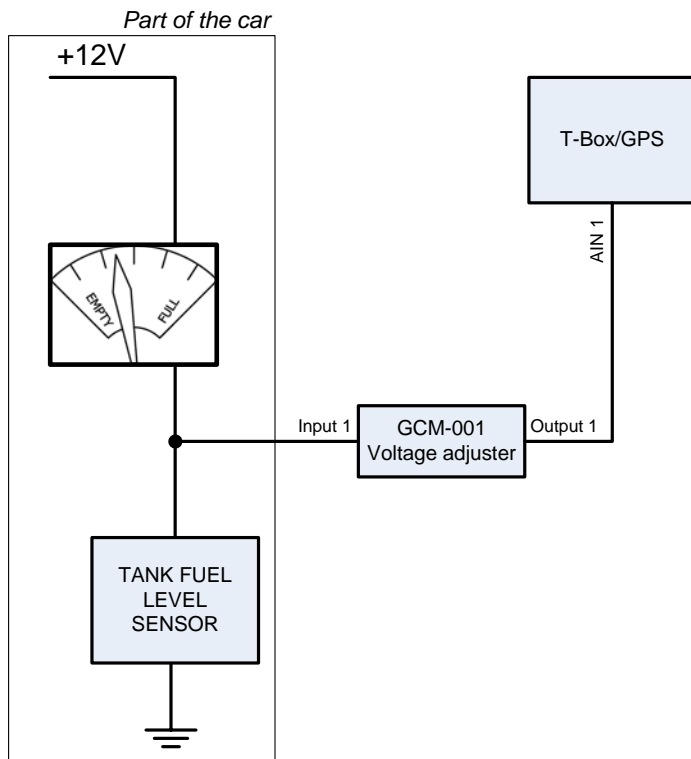


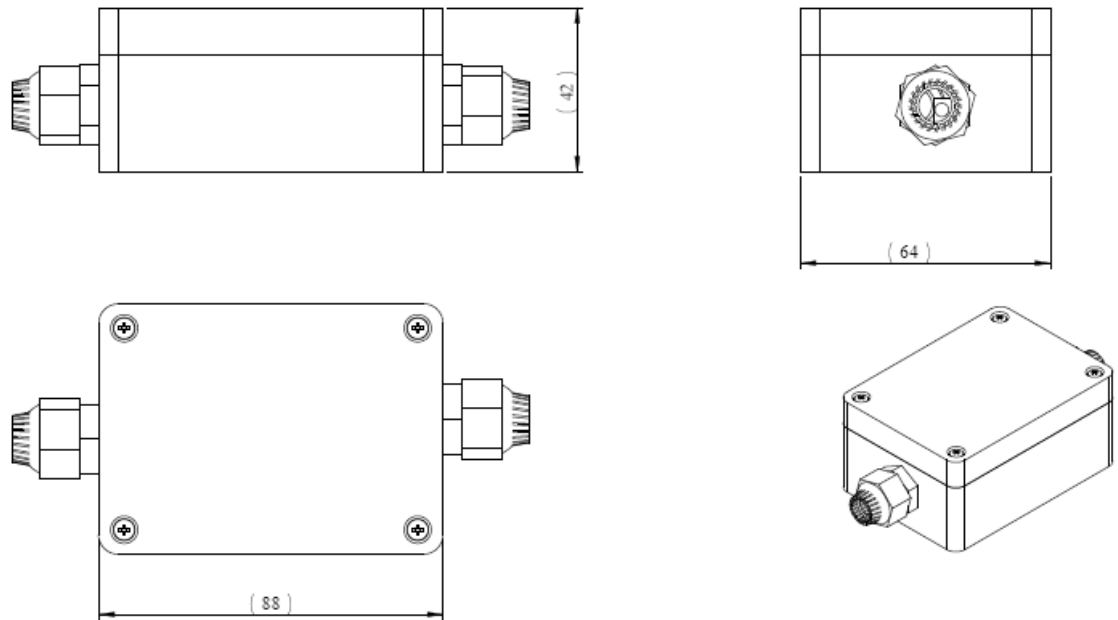
Fig.9 describes connection scheme to the FM3101. After connection to the tank fuel level sensor please calibrate GCM-001 (adjust so, that if tank is full voltage on output 1 would be 2.8 Volts). FM3101 will register this parameter and be able to inform user about its value.

Figure 9. GCM-001 connection to fuel sensor scheme



## 7.2 Temperature sensor TTJ-101

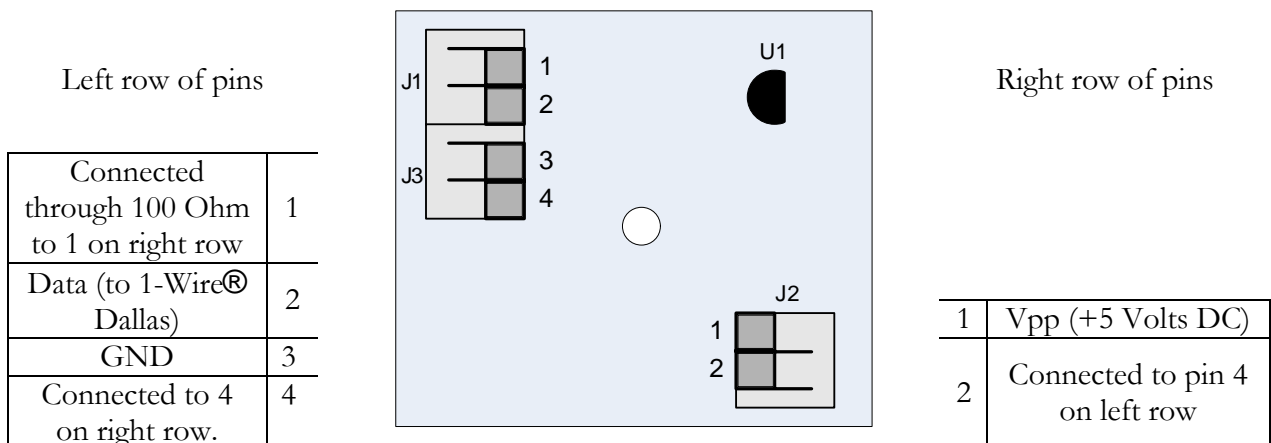
To simplify mounting of thermometer in the object it is placed on PCB and inserted into box. Integrator of the system should solder the FM3101 wires to PCB and place the sensor wherever he wants to measure the temperature.



Dimensions in millimeters, tolerance  $\pm 1\text{mm}$

Figure 10. TTJ-101 dimensions & spec.

In TTJ-100 is used Dallas digital thermometer DS1820. It is possible to join up to five thermometers parallel and measure the temperature in 5 places in the object (see chapter **Error! Reference source not found.**). The picture bellow describes pinout of the TTJ-100.





## 8. COMMUNICATION PROTOCOLS

For communication between APLICOM 12i modem, MCU, GPS module and RFID receiver ModBus protocol is applied. All of possible commands are described in tables below.

### 8.1 Power management command set

Name	Code	Parameter	Description	Answer	Description
Get power supply state	0x06	-	-	1 symbol. - 0, 1, 2, 3, 4 2 symbol. – last charge time (min)	0 – external power supply OK, battery charged 1 – battery is charging 2 – power supply is from battery 3 – accumulator discharged 4 – charge error
Enter power save state	0x07	0-59	Time in minutes	-	-
Get power supply voltage	0x09	-	-	0-29000	Power supply voltage in mV*
Get battery voltage	0x0A	-	-	0-10000	Battery voltage in mV
Get battery charge current	0x0B	-	-	0-1294	Battery charge current in mA
Get status of GPS antenna power supply	0x0D	-	-	0, 1, 2	0 – normal state 1 – short circuit 2 – not plugged
Temperature of battery	0x0E	-	-	1 byte	Temperature in °C
Battery charge ON/OFF	0x11	0-1	-	-	0 – Battery charge ON 1 – Battery charge OFF
Power down mode	0x20	-	-	-	If module has no external voltage supply, switches the module off.

### 8.2 Event counter command set

Name	Code	Parameter	Description	Answer	Description
Read value of counter (DMIN 1)	0x12	-	-	4 bytes	Unsigned long – value of counter
Turn off counter (DMIN 1)	0x13	-	-	-	

\* - Real voltage on power supply is higher then answers of command 0x09 by 0.7 Volts. It is so, because of protection diode on power supply pin.



### 8.3 “1-WIRE®” command set

Name	Code	Parameter	Description	Answer	Description
Calculate existing sensors	0x14	Sensor number		Number of sensors, 1 symbol	
Read sensor data	0x15			Temperature, 2 symbols	If answers 0xF000 it means error in temperature read
Sensors initialize	0x16			Number of sensors; 1 symbol	Calculating sensors, and attaching ID (0, 1, 2, 3, 4)
Get_I-Button	0x26		Gets I-Button ID	8 bytes	I-Button present: :01 26 01 id id id id id id crc(ib)  lrc No I-Button: :01 26 00 00 00 00 00 00 00 00  lrc I-Button read error: :01 26 11 11 11 11 11 11 11 11  lrc

For more detail information about thermometer please see “Dallas Semiconductors” digital thermometer DS1820 specification.

For more detail information about thermometer please see “Dallas Semiconductors” I-Button DS1990A specification.

## 8.4 Digital input command set

Name	Code	Parameter	Description	Answer	Description
Read digital input status	0x14	0-1	1 byte. Input index	0, 1	Logic input status

## 8.5 Watchdog command set

Name	Code	Parameter	Description	Answer	Description
Watchdog_enable	0x18	1	1 byte	1	Enables watchdog
Watchdog_disable	0x18	0	1 byte	0	Enables watchdog

Watchdog is watching for N12i OUT 4 pin, if it has not changed per 20 min, it restarts N12i. If after first restart there is no change, second restart comes after 1 hour, the same third etc. It is recommended to change status of N12i OUT4 every half minute.



## 8.6 Real Time Clock command set

Name	Code	Parameter	Description	Answer	Description
Set_time	0x22	7 bytes :01 22 ss mm hh dwdw dm mm yy LRC	Setting the time	7 bytes :01 22 ss mm hh dwdw dm mm yy crc(t) LRS	Set RTC time
Set_RTC_CR	0x23	2 bytes :01 23 cr1cr1 cr2cr2 LRC	Setting the control register	2 bytes :01 23 cr1cr1 cr2cr2 crc(t) LRS	
Read_RTC_CR	0x24	-	Get CR value	2 bytes :01 24 cr1cr1 cr2cr2 crc(t) LRS	
Read_RTC	0x25	-	Get time value	7 bytes :01 25 ss mm hh dwdw dm mm yy cr c(t) LRC	

CR – RTC (RS5C338A) management registers

For more detail information about RTC please see “Ricoh” RS5C338A datasheet.



## 9. TECHNICAL SUPPORT

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If you encounter any problems when using our products, please contact our technical support by writing an e-mail to [support@teltonika.lt](mailto:support@teltonika.lt) . We will be pleased to help you.

If you are interested in other products from Teltonika, please visit our website [www.teltonika.com](http://www.teltonika.com) , where you will find our newest products.

If you are interested in product pricing or want to order our products with different antennas, connectors or built-in programs, please contact our sales department by writing an e-mail to [sales@teltonika.lt](mailto:sales@teltonika.lt) .



## 10.CHANGES LOG SHEET

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Nr.	Date	New version number	Comments